

What is claimed is:

1. An electro-static discharge protection device comprising:

a first conductive type well and a second  
5 conductive type well which are formed in a surface of  
the first conductive type layer or a first conductive  
type substrate;

a first high concentration second conductive  
type region, a first high concentration first  
10 conductive type region, and a second high  
concentration second conductive type region which are  
formed in a surface of said second conductive type  
well; and

a third high concentration second conductive  
15 type region which is formed in a surface of said first  
conductive type well,

wherein said first high concentration second  
conductive type region and said first high  
concentration first conductive type region are  
20 connected with a first power supply of a potential,

said third high concentration second conductive  
type region is connected with a second power supply  
having a potential different from the potential of  
said first power supply, and

25 said second high concentration second  
conductive type region is set to a potential different  
from said first power supply.

2. An electro-static discharge protection device comprising:

a first conductive type layer or a first conductive type substrate;

5 a first well of a first conductive type and a second conductive type well which are formed adjacent to each other in a surface of said first conductive type layer or said first conductive type substrate;

a second well of the first conductive type  
10 which is formed in the surface of said first conductive type layer or said first conductive type substrate;

a first high concentration second conductive type region, a second high concentration second  
15 conductive type region and a first high concentration first conductive type region, which are formed in a surface of said second conductive type well;

a third high concentration second conductive type region which is formed in a surface of said first  
20 well of the first conductive type; and

a second high concentration first conductive type region which is formed in a surface of said second well of the first conductive type,

wherein said first high concentration second  
25 conductive type region and said first high concentration first conductive type region are connected with a first power supply of a potential,

said third high concentration second conductive type region and said second high concentration first conductive type region are connected with a second power supply having a potential different from the potential of said first power supply, and

said second high concentration second conductive type region is connected with a trigger current supply circuit.

10 3. The electro-static discharge protection device according to claim 2, wherein said trigger current supply circuit has a MOS transistor connected between said second high concentration second conductive type region and said second power supply.

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4. The electro-static discharge protection device according to claim 2, wherein said trigger current supply circuit has diodes connected between said second high concentration second conductive type region and said second power supply.

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5. The electro-static discharge protection device according to claim 2, wherein said first high concentration first conductive type region and said third high concentration second conductive type region are arranged adjacent to each other.

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6. The electro-static discharge protection device according to claim 2, wherein said second high concentration second conductive type region and said third high concentration second conductive type region  
5 are adjacent to each other.

7. The electro-static discharge protection device according to claim 2, wherein each of said first high concentration second conductive type region and said  
10 second high concentration second conductive type region comprises a plurality of divisional regions,  
each of said plurality of division regions of said first high concentration second conductive type region and each of said plurality of division regions  
15 of said second high concentration second conductive type region are alternately arranged in a direction orthogonal to a direction of arrangement of said second high concentration first conductive type region and said third high concentration second conductive  
20 type region, and

said first high concentration first conductive type region extends between every two of said plurality of division regions.

25 8. The electro-static discharge protection device according to claim 2, wherein said first high concentration second conductive type region are

separated into two divisional regions which are arranged separately in a direction orthogonal to a direction of arrangement of said second high concentration first conductive type region and said  
5 third high concentration second conductive type region,

said second high concentration second conductive type region is arranged between the two divisional regions of said first high concentration  
10 second conductive type region, and

said first high concentration first conductive type region extends between each of the two divisional region of said first high concentration second conductive type region and said second high  
15 concentration second conductive type region.

9. The electro-static discharge protection device according to claim 2, wherein said third high concentration second conductive type region is  
20 separated into two divisional regions which are separately arranged in a direction orthogonal to a direction of arrangement of said second high concentration first conductive type region and said third high concentration second conductive type  
25 region,

said second conductive type well extends between the two divisional regions of said third high

concentration second conductive type region, and

said second high concentration second conductive type region is arranged in an extended region of said second conductive type well.

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10. The electro-static discharge protection device according to claim 2, wherein each of said first high concentration second conductive type region and said third high concentration second conductive type region is separated into two divisional regions which are arranged separately in a direction orthogonal to a direction of arrangement of said second high concentration first conductive type region and said third high concentration second conductive type region,

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said second conductive type well extends between the two divisional regions of said third high concentration second conductive type region,

said second high concentration second conductive type region is arranged in an extended region of said second conductive type well, and

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said first high concentration first conductive type region extends between the two divisional regions of said first high concentration second conductive type region.

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11. The electro-static discharge protection device

according to claim 2, wherein said first high concentration second conductive type region is separated into two divisional regions which are arranged separately in a direction orthogonal to a direction of arrangement of said second high concentration first conductive type region and said third high concentration second conductive type region.

said first high concentration first conductive type region has a notch portion in its center in a division direction of said first high concentration second conductive type region on a side of said third high concentration second conductive type region, and

said second high concentration second conductive type region is arranged at the notch portion.

12. An electro-static discharge protection device comprising:

a first conductive type well and a second conductive type well which are formed in a surface of a first conductive type layer or a first conductive type substrate;

a first high concentration second conductive type region, a first high concentration first conductive type region and a second high concentration second conductive type region which are formed in a

surface of said second conductive type well; and

a third high concentration second conductive type region and a third high concentration first conductive type region which are formed in a surface of said first conductive type well,

wherein said first high concentration second conductive type region and said first high concentration first conductive type region are connected with a first power supply of a potential,

10 said third high concentration second conductive type region is connected with a second power supply of a potential different from the potential of said first power supply, and

said second high concentration second conductive type region and said third high concentration first conductive type region are connected through a diode.

13. An electro-static discharge protection device comprising:

a first conductive type layer or a first conductive type substrate;

a first well of a first conductive type and a second conductive type well which are formed adjacent to each other in a surface of said first conductive type substrate or said first conductive type layer;

a second well of the first conductive type



which is formed in the surface of said first  
conductive type layer or said first conductive type  
substrate;

a first high concentration second conductive  
5 type region, a first high concentration first  
conductive type region and a second high concentration  
second conductive type region which are formed in a  
surface of said second conductive type well;

a third high concentration first conductive  
10 type region and a third high concentration second  
conductive type region which are formed in a surface  
of said first well of the first conductive type; and

a second high concentration first conductive  
type region which is formed in a surface of said  
15 second well of the first conductive type,

wherein said first high concentration second  
conductive type region and said first high  
concentration first conductive type region are  
connected with a first power supply of a potential,

20 said third high concentration second conductive  
type region and said second high concentration first  
conductive type region are connected with a second  
power supply of a potential different from the  
potential of said first power supply, and

25 said second high concentration second  
conductive type region and said third high  
concentration first conductive type region are

connected through a diode.

14. The electro-static discharge protection device according to claim 13, wherein said third high concentration second conductive type region is separated into two divisional regions which are separately arranged in a direction orthogonal to a direction of arrangement of said second high concentration first conductive type region and said third high concentration second conductive type region,

said second conductive type well extends between the two divisional regions of said third high concentration second conductive type region,

15 said second high concentration second conductive type region is arranged in an extended region of said second conductive type well,

said third high concentration first conductive type region is separated into two divisional regions which are arranged outside an opposing region of said first high concentration first conductive type region and said third high concentration second conductive type region.

25 15. The electro-static discharge protection device according to claim 14, wherein said second conductive type well extends to a back of an opposing region of

said divisional regions of said third high concentration first conductive type region and said second high concentration second conductive type region.

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16. The electro-static discharge protection device according to claim 12, wherein said second high concentration second conductive type region and said third high concentration second conductive type region  
10 are arranged adjacent to each other.

17. The electro-static discharge protection device according to claims 13, wherein said second high concentration second conductive type region and said  
15 third high concentration second conductive type region are arranged adjacent to each other.

18. The electro-static discharge protection device according to claim 1, wherein a width of said second  
20 high concentration second conductive type region is a minimum width where a contact can be formed in a permissible range of a design rule.

19. The electro-static discharge protection device  
25 according to claim 2, wherein a width of said second high concentration second conductive type region is a minimum width where a contact can be formed in a

permissible range of a design rule.

20. The electro-static discharge protection device according to claim 12, wherein a width of said second  
5 high concentration second conductive type region is a minimum width where a contact can be formed in a permissible range of a design rule.

21. The electro-static discharge protection device  
10 according to claim 13, wherein a width of said second high concentration second conductive type region is a minimum width where a contact can be formed in a permissible range of a design rule.

15 22. An electro-static discharge protection device comprising:

a P-type layer or a P-type substrate;

an N well which is formed in a surface of said  
P-type layer or said P-type substrate;

20 a first high concentration N-type region, a first high concentration P-type region and a second high concentration N-type region which are formed in a surface of said the N well;

a third high concentration N-type region, a  
25 second high concentration P-type region and a third high concentration P-type region which are in the surface of said P-type substrate or said P-type layer;

a first resistance element connected between said first high concentration P-type region and said second high concentration N-type region; and

a second resistance element connected between  
5 said second high concentration P-type region and said third high concentration P-type region,

wherein said first high concentration N-type region and said first high concentration P-type region are connected with a first power supply of a  
10 potential,

said third high concentration N-type region and said second high concentration P-type region are connected with a second power supply of a potential different from the potential of said first power  
15 supply, and

said second high concentration N-type region is connected with a trigger current supply circuit.

23. The electro-static discharge protection device  
20 according to claim 22, wherein said second high concentration N-type region and said third high concentration N-type region are arranged adjacent to each other.

25 24. The electro-static discharge protection device according to claim 22, wherein said second high concentration N-type region has a minimum width where

a contact can be formed in a permissible range of design rule.

25. An electro-static discharge protection device  
5 comprising:

a first conductive type layer or a first  
conductive type substrate;

a first conductive type well and a second  
conductive type well which are arranged adjacent to  
10 each other in a surface of said first conductive type  
substrate or said first conductive type layer;

a first high concentration first conductive  
type region, a second high concentration first  
conductive type region and a first high concentration  
15 second conductive type region which are formed in a  
surface of said second conductive type well; and

a second high concentration second conductive  
type region and a third high concentration first  
conductive type region which are formed in a surface  
20 of said first conductive type well,

wherein said first high concentration second  
conductive type region and said first high  
concentration first conductive type region are  
connected with a first power supply of a potential,

25 said second high concentration second  
conductive type region and said third high  
concentration first conductive type region are

connected with a second power supply of a potential different from the potential of said first power supply, and

said second high concentration first conductive  
5 type region is connected with a trigger current supply circuit.

26. The electro-static discharge protection device according to claim 25, wherein said second high  
10 concentration first conductive type region and said second high concentration second conductive type region are arranged adjacent to each other.

27. The electro-static discharge protection device  
15 according to claim 25, wherein each of said first high concentration second conductive type region and said first high concentration first conductive type region is separated into a plurality of divisional regions which are arranged into a direction orthogonal to a  
20 direction of arrangement of said first high concentration second conductive type region and said first high concentration first conductive type region, and

said second high concentration first conductive  
25 type region extends between every two of division regions.

28. The electro-static discharge protection device according to claim 27, wherein a portion of extending between said division regions has a minimum width such that a contact can be formed in a permissible range of  
5 design rule, and

a portion of said second high concentration first conductive type region other than said extending portion has a width less than the minimum width.

10 29. An electro-static discharge protection device comprising:

a first conductive type layer or a first conductive type substrate;

a first conductive type well and a second  
15 conductive type well which are arranged adjacent to each other in a surface of said first conductive type substrate or said first conductive type layer;

a first high concentration first conductive type region and a first high concentration second  
20 conductive type region which are formed in a surface of said second conductive type well; and

a second high concentration first conductive type region and a second high concentration second conductive type region which are formed in a surface  
25 of said first conductive type well,

wherein said first high concentration first conductive type region is connected with a first power



supply of a potential;

said second high concentration second  
conductive type region and said second high  
concentration first conductive type region are  
5 connected with a second power supply of a potential  
different from the potential of said first power  
supply, and

said first high concentration second conductive  
type region is connected with a trigger current supply  
10 circuit.

30. The electro-static discharge protection device  
according to claim 29, wherein said first high  
concentration second conductive type region and said  
15 second high concentration second conductive type  
region are arranged adjacent to each other.

31. The electro-static discharge protection device  
according to claim 29, wherein said first high  
20 concentration second conductive type region has a  
minimum width such that a contact can be formed in a  
permissible range of design rule.

32. The electro-static discharge protection device  
25 according to claim 29, wherein said first high  
concentration first conductive type region is  
separated into a plurality of divisional regions which

are arranged in a direction orthogonal to a direction of arrangement of said second high concentration second conductive type region and said second high concentration first conductive type region, and

5        said first high concentration second conductive type region extends between every two of said plurality of divisional regions.

33.        The electro-static discharge protection device  
10 according to claim 32, wherein the extending portion of said first high concentration first conductive type region has a minimum width such that a contact can be formed in a permissible range of design rule, and  
            another portion of said first high  
15 concentration first conductive type region other than said extending portion has a width less than said minimum width.

34.        The electro-static discharge protection device  
20 according to claim 1, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

35.        The electro-static discharge protection device  
25 according to claim 2, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

36. The electro-static discharge protection device according to claim 12, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

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37. The electro-static discharge protection device according to claim 13, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

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38. The electro-static discharge protection device according to claim 22, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

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39. The electro-static discharge protection device according to claim 25, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

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40. The electro-static discharge protection device according to claim 29, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

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41. The electro-static discharge protection device according to claim 1, wherein a gate electrode is

provided between said high concentration regions adjacent to each other.

42. The electro-static discharge protection device  
5 according to claim 2, wherein a gate electrode is provided between said high concentration regions adjacent to each other.

43. The electro-static discharge protection device  
10 according to claim 12, wherein a gate electrode is provided between said high concentration regions adjacent to each other.

44. The electro-static discharge protection device  
15 according to claim 13, wherein a gate electrode is provided between said high concentration regions adjacent to each other.

45. The electro-static discharge protection device  
20 according to claim 22, wherein a gate electrode is provided between said high concentration regions adjacent to each other.

46. The electro-static discharge protection device  
25 according to claim 25, wherein a gate electrode is provided between said high concentration regions adjacent to each other.

47. The electro-static discharge protection device according to claim 29, wherein a gate electrode is provided between said high concentration regions adjacent to each other.

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48. An electro-static discharge protection device comprising:

a P-type layer or a P-type substrate;

an N well which is formed in a surface of said

10 P-type layer or said P-type substrate;

a first high concentration N-type region and a first high concentration P-type region which are formed in a surface of said the N well;

a second high concentration N-type region and a  
15 second high concentration P-type region and a third high concentration P-type region which are in the surface of said P-type substrate or said P-type layer;

first and second resistance elements connected between said first high concentration P-type region  
20 and said first high concentration N-type region; and

third and fourth resistance elements connected between said second high concentration N-type region and a first predetermined potential,

wherein a trigger current supply circuit is  
25 connected with a node between said first and second resistance elements and a said third and fourth resistance elements,

said second high concentration N-type region and said third high concentration P-type region are connected with said first predetermined potential, and

said first high concentration P-type region is  
5 connected with a second predetermined potential.

49. The electro-static discharge protection device according to claim 48, wherein said second high concentration N-type region and said second high  
10 concentration P-type region are arranged adjacent to each other.

50. The electro-static discharge protection device according to claim 48, wherein said first and third  
15 resistance elements are connected with said first high concentration P-type region and said first predetermined potential, and have resistance values lower than a resistance value of said N well and a resistance value of said P-type layer or said P-type  
20 substrate, respectively, and

said second and fourth resistance elements are connected with said first high concentration N-type region and said second high concentration N-type region and resistance values of said second and fourth  
25 resistance elements are determined based on a desired hold voltage, respectively.

51. The electro-static discharge protection device according to claim 48, wherein a region where silicide is not formed is provided between said high concentration regions adjacent to each other.

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52. The electro-static discharge protection device according to claim 48, further comprising:

a gate provided between every two of said high concentration regions, and

10 wherein said high concentration regions are formed using said gates as a mask.